Eight lessons from *karesansui*

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Eight structural aspects of Japanese dry rock gardens are presented as suggested conceptual qualities for probing the underlying logic of naturalistic landscape design. The aim is to better equip a methodic research approach into visually expressed intuitive design properties which are very difficult to articulate otherwise. The presentation is not exhaustive, and should be considered an open invitation for the creation of a record of clear examples from which the intuitive design of the Japanese garden can be more fully understood.
Key words: Japanese dry rock gardens, *karesansui*

Agt lesse van *karesansui*
Agt strukturele aspekte van die Japanese drok-kliptuin word aangebied as voorgestelde kwaliteite vir n ondersoek na die logika van naturalistiese landskapontwerp. Die doel is om n metodiese ondersoekbenadering beter toe te rus ten opsigte van die intuotiewe eienskappe wat visueel uitgedruk is, maar wat andersins moeilik geartikuleer kan word. Hierdie benadering word nie as geheel en al omvattend aangebied nie, maar behoort beskou te word as n ope uitnodiging vir die daarstelling van n opgawe van voorbeelde wat met sekerheid uitgekbaar is as dii waarin die intuotiewe ontwerp van die Japanese tuin beter verstaan kan word.

Karesansui (lit. dry mountains and waterscapes) represents a highly sophisticated form of landscape design, where insights into the beauty of nature are expressed through abstracted arrangements of rock clusters on expanses of raked gravel. Vegetation may be as sparse as a few clumps of moss (e.g. figure 1). This type of landscape design qualifies as *naturalistic* landscape design, meaning that, while *karesansui* emulates some aspects of complex natural scenery, it is truly artificial and a carefully composed arrangement of objects found in nature. As such, *karesansui* has informally been considered as the visual art of landscape painting in three dimensions.

Japanese gardens are exemplary of landscape designs where human cultured space seamlessly joins nature. The wealth of Japanese gardens, garden design guidelines from old and recent texts, and present day garden construction practice offer deep insight into the intuitions and intentions from which the garden emerges as designed space. An understanding of the aesthetics of the Japanese garden is therefore certain to gain much from a methodical investigation of this rich tradition.

Various established concepts in the garden aesthetic remain difficult or even impossible to articulate, perhaps since they are rooted so deeply in phenomenal awareness and intuition. The concept of *ma*, for example, can be grasped only through direct experience of various examples of events occurring at different times and in different spaces (Nitschke 1966). Otherwise it remains at its shallow verbal definition: *ma* as the interval between events, whether spatial, temporal or both.

Yugen is a similarly evasive concept, conveying a sense of profundity in events. It has been phrased as the awareness of deep unseen significance within the shadows (in a garden, or between objects), pregnant with mystery (Covello & Yoshimura 1984; Johnson 2003; Ueda 1967). Various other expressions, such as softness, infinity, simplicity, harmony and balance have been used to describe aspects of the garden design. Interaction with an actual gardening team soon reveals that the use of these terms do not refer to single aspects of the garden, but simultaneously relate to both the whole and its parts. Difficult to formalize, these concepts refer to a very specific visual intuition and should therefore benefit from a methodical analysis where the visual intuition and its actual expression in terms of garden design elements are

compared. I propose that one sets out with a key concept, from within the realm of the Japanese ascetic philosophy, which has contributed richly to the art of gardens: *unhindered perception*, or perceiving the world as it is (Kraft 1981).

Arnheim defines the act of perception as the minimization of tension between processes of sensory representation, and generation of internal expectations and intentions (Arnheim 1966). From this perspective the Japanese garden effectively engenders unhindered perception since it functions as bridge between intentions arising in the viewer and the sensory present, arising from the garden as visual (and other sensory) stimulus. If Arnheim correctly defined perception, then we should consider the intentions and expectations of the viewer, the sensory experience of the garden as stimulus, and the structure of the garden with the interactions it allows. Thus we would gain a deeper scientific understanding of how the garden functions as design.

The following sections consider eight different structural aspects of dry rock garden design as a probe of the senses and intentions arising from selected examples of Japanese garden design. The eight aspects presented do not constitute eight laws of garden construction, but are only instance of design techniques that have been applied with great effect in at least a few instances. This research is part of a larger project that aims to understand the relationship between visual design effects and human perception in naturalistic landscapes.

Dramatic entry, quiet repose

I propose here that the path of entry to numerous Japanese gardens suggests an intentional layout where the sensory impact of the visual scenery increases as the main courtyard is approached, reaching a dramatic climax at the first glance of the garden. From this point the sensory intensity of the design subsides as the viewer moves toward one or more of the intended canonical viewpoints, where the garden can be observed with calm.

Figure 1
Left: One of the earliest photographs of Ryoanji (Usui 1910). The influence of the camera is already visible here. In order to fit the entire composition into the limited frame of the camera, the canonical viewpoint has to be neglected. Right: An illustration of Ryoanji before the advent of the photographic camera (Akisato 1799). As with his other garden illustrations, he depicts Ryoanji from the intended canonical viewing position.

A good example is Daisenin in the Daitokuji complex in Kyoto. Upon entry one views the first courtyard from the side, so that the dense rock composition is visible in a single glance. The sensory effect is one of ornate complexity. Abstractions of this type of scenery, i.e. triangular upward pointing peaks or cones, are known to effectively convey a sense of human energeticism (Takahashi 1995). As one moves further into the viewing room, the rocks seem to face towards one's self at given vantage points. This level of engagement gives a sense of quiet intimacy with the garden, not experienced at the entrance. Successive gardens along the

corridor are increasingly abstract, until only an expanse of raked sand remains. Horizontal lines, the abstraction produced in the raked sand, effectively convey a visual sense of tranquility (Takahashi 1995).

Ryoanji is another good example of a layout where a dramatic entry is followed by quiet observation. The original entry way has been modified to the extent that the intentional visual experience is much reduced (Oyama 1995). Originally, the approach through the expansive outer precinct gardens would bring the visitor to a flight of narrowing stone steps leading to a gate through which one could literally ascend into the courtyard garden. This vertical transition from the lush exterior to the sparse and empty interior would have created a deep visual impact. From there a roofed corridor would cross the graveled expanse towards the verandah.

The well known rock composition would flank the corridor from the left, with a smaller, empty expanse of gravel only, to the right of the corridor. The contrast between emptiness and its opposite would thus be experienced again, in a more subtle form. The rocks are intentionally arranged to heighten the sense of dynamism as one moves along the corridor. The tallest, most complex rock cluster is placed closest to the corridor, while the smallest clusters are placed farthest away. As one move along the corridor, motion parallax gives the impression that rock clusters slide around each other, appearing like a valley unfolding as one approaches (figure 1, left). The size gradient of largest to smallest rocks heightens the experience of the deep vastness of the physical layout of this landscape. The courtyard walls at Ryoanji are intentionally sloped to become lower towards the south-east and south-west corners, further enhancing the impression of a space deeper and wider than it actually is.

Thinking about Arnheim`s approach to visual perception, I would suggest that the act of entry into the garden aligns the visitor`s expectations of deep revelation with an equally strong sensory impact. The initial cancellation of the tension between intensions and senses in this regard opens the viewers towards matching their internal state to the deeper intended visual presentation of the garden.

If the viewers could match their intentions with that of the garden as sensory landscape, they would, in a sense, become that landscape. The composition of the rock garden is therefore of utmost importance, since quiet viewing does not result in formless nothingness, but instead, shaping of one's self onto nothing but the ideal, and experiencing a deep sense of the harmonious connectivity between things.

For this purpose, the temple verandah provides an excellent viewing location. A canonical viewpoint is typically incorporated into *shoin* (lit. writing room) style architecture, where an writing desk is built into an alcove on the south side of a building, and usually overlooking a garden. *Shoin* architecture dates from the *Muromachi* period (1333-1545), when *karesansui* garden design reached an unprecedented level of sophistication. The spatial relationship between the garden and the classical, or canonical viewing location of the 'writing room' was of specific importance. Gardeners intentionally created designs where the garden as a whole and each individual element would face the viewing location in a controlled manner (figure 1, right). In *Ryoanji*, this viewing point seems to engender calm viewing, and thus a chance to learn and experience unhindered perception by direct experience. The following sections will deal with physical aspects underlying visual calmness from the canonical viewpoint.

Tuned visual pragnanz

The ideal rock garden should equal nature in its structural complexity, while achieving the same high degree of organizational order. Randomly casting rocks onto the raked sand would fall

short of the ideal, since it would reveal only what it is, namely a collection of rocks, scattered by a human into a raked expanse of sand.

The concept of pragnanz, after the gestalt school of psychology (Koffka 1935; Wertheimer 1938), is helpful in understanding the complexity and order in the garden composition. Pragnanz, or visual pregnancy, refers to the natural tendency for certain visual parts to perceptually appear as a grouped whole. In nature, all parts belong to larger and larger wholes. To capture this sense of complex order, the arrangement of rocks should be such that simple local perceptual grouping remains subordinate to the pragnanz of more inclusive global structures.

The gestalt school has identified a small number of visual factors which characterizes the grouping of parts into wholes. These are proximity, similarity, good continuation, symmetry, enclosedness and simplicity. The gestalt factors hint at the internal assumptions used by the visual system as it attempts to separate different visual objects form one another. By weakening and tuning the visual cues which embody gestalt cues, a visual stimulus can be tuned to sustain perceptual grouping at the most global structural level.

The sharp intuition of the rock gardener has culminated in a set of design guidelines aimed at tuning the gestalt to this extent (Van Tonder & Lyons 2005). Proximity between rocks is finely adjusted so that no single stone seems to break away from its cluster, and no single cluster appears separate from the design as a whole. Similarity between rock shapes, rock textures and the collective shape of entire clusters is tuned such that they often appear roughly triangular, but without any specific shape appearing more than once. There is no good continuation in the spatial arrangement and orientation between objects, since one never encounters alignment of three or more objects onto the same straight line or otherwise apparent smooth curve. Visual junctions between objects are also such that one does not see lines crossing each other. Visual edges and boundaries terminate in trilateral junctions, as is nearly always the case with pristine natural structure.

Bilateral symmetry of individual rocks and the composition of rock clusters is always avoided. Rocks are never arranged onto discernible closed paths, and rocks are buried firmly to ensure that visual junctions between rocks and sand do not betray the fact that the rocks are actually disconnected from solid bedrock. Simplicity, difficult to achieve, results from removing rocks and clusters that do not qualitatively increase the complexity and order of the entire design.

As such, the Japanese gardening tradition considers similar visual factors as the gestalt school of vision, albeit cast in different terminology and implemented with different intent. This convergence is not surprising considering that both dealt with human visual perception.

Infinite structure in minimal composition

The infinite extendedness of actual nature cannot be literally achieved in the garden. It would be as futile as an attempt to physically construct a mathematically pure fractal.

A limited number of appropriately arranged stimulus elements could, however, evoke the *perceptual* equivalent infinity. The previous section already implied this possibility. Similarity between building blocks at various spatial scales of the composition serves as a clear clue of how structure could be extrapolated or interpolated to a boundless range of other scales. The range of possible completions of this infinite structure makes it impractical to consider in terms of a single solution. Rather then directly seeing the completion resulting from this hierarchy of similar building blocks, the viewer senses the potential presence of such an infinite perceptual

grouping. This would qualify as one of the origins of *yugen*, or 'the awareness of deep unseen significance within the shadows, pregnant with mystery'.

Infinite structure is further engendered through the adherence to classical guidelines concerning the placement of rocks. Visual junctions formed where gravel meets the half buried rock are controlled to form angles larger than ninety degrees (figure 2-AD). In doing so, the rock is perceptually completed as an object which diverges underground, extending into an unseen buried base which may link in any intricate way with the underground continuation of other rock clusters, and even spread beyond the borders of the garden courtyard. This form of good continuation evokes a more vivid although still unseen percept of an actual infinite surface.

A key point to remember is that the visual percept of infinity is achieved with a finite, limited number of rocks.

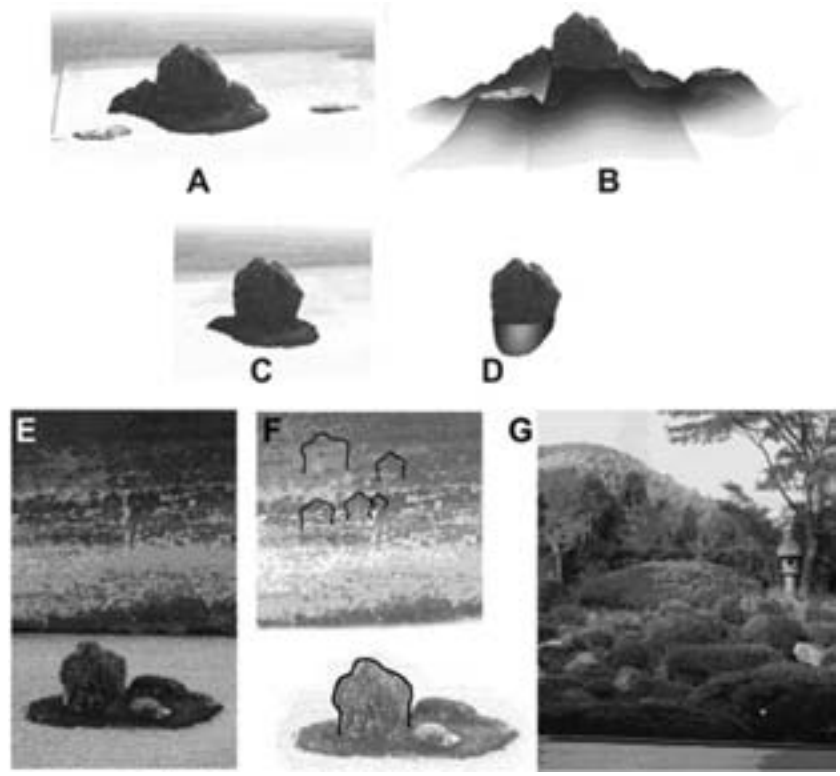

Figure 2

Depending on visual junctions between rocks and gravel (A) a cluster would complete as a part of a more extensive mass (B) or pop out (C,D) as an isolated object. An earthen wall may provide the ideal rough texture within which the rock composition can be perceptually completed (E). For example, groupings similar in shape to that of rocks may become salient in this texture (F). In *shakkei* (lit. borrowed scenery) the partial view of a mountain (G) is visually 'borrowed' as part of the design. It engenders complex perceptual completion and grouping between garden elements and the outside landscape.

Miniaturization and magnification

Considering that the rock garden is a miniature semblance of a vast landscape of mountains in mist, or islands in the ocean, it supports unhindered perception in the sense that the entire vastness can be inspected in a single glance. The egocentric perception of the viewer is thus brought to a macroscopic scale.

The rock garden also resembles a small portion of dust, underfoot, where the shapes of small grains of gravel would resemble rocks many times their own size. The viewer is thus simultaneously presented with a microscopic egocentric view.

And at the human scale, the garden irrefutably remains what it is: a small space with raked sand and rocks. The design scales the perceptual self in all directions.

Naturalistic texture

At the finest visible scale, earthen walls, rock surfaces, moss and gravel obtain similar visual appearances, namely that of a pseudo random noise dot pattern. Up to the smallest details which the eye can discern, there is thus a continuation of non-repetitive structure, and therefore every reason to infer that this structure, and hence the ordered complexity of the garden, extends to even smaller scales. An example of how the shape of design elements, such as rocks, may bias perception of potential figures in noise textures appears in figure 2E~F.

While Japanese gardens are hailed as examples of minimalist design, the use of such rich textures suggests the contrary. The senses are maximally engaged in complexity. Minimalism occurs not at the sensory level, but in holistic perceptual grouping: Redundancy, that is, obvious and repetitive perceptual relationships, are minimized.

The presentation of the entire garden within this finely grained texture evokes the impression that all is seen through a discernible optical medium, a kind of visual ether. Again, this may be a helpful method for altering the intentions of the viewer, from an onlooker in egocentric space to a distributed substance, not distinct from the air, sand, or rocks.

Excluded visual structure

The sand and earthen walls further engender the percept of infinite structure by blocking visual access to clashing structural orders. Trees are only partially visible behind walls. Such islands of visual structure yield more easily to the control of the gardener, and serve as ideal building blocks from which the viewer extrapolates and constructs a percept of the scenery as a whole, as it would appear if the trees, rocks and other elements were visible as perfect wholes.

Gravel creates a visual backdrop on which the outlines of rocks are clearly perceptible. While such visual simplicity hardly ever occurs in nature, the garden design offers the viewer an opportunity to perceive the total structure of rocks in the absence of the usual intrusions at the human scale. In a real forest, one would find leaves, dead branches, scattered stones and pieces of wood and other objects cluttering and clashing with the perception of order purely belonging to given objects.

At larger scales, objects lying far outside the perimeters of the garden can be incorporated visually into the design, to enhance the impression of extensiveness of the garden itself. Usually, only a small part of such a distant object, such as a mountain peak, is visible in the garden, while its intricate structures, such as foothills, would be kept out of sight (figure 2G).

Structured emptiness

While the complex structural organization of a rock garden like Ryoanji does not yield a clearly discernible visual hierarchy, the unseen order can be revealed via mathematical transformation of the design composition.

Medial axis transformation (Blum 1973), instrumental in compact shape encoding, can be applied to reveal an abstract shape scaffold relating to the empty space between rock clusters. In Ryoanji, this scaffold reveals a clear hierarchical dichotomous tree, converging from all sides

of the garden onto the viewing verandah, and from there aligned with the canonical viewing position of the temple main hall (Van Tonder, Lyons & Ejima 2002). The viewer is faced by an undeniably ordered yet completely invisible structure at the largest scale of the garden design. More specifically, this is an invisible *visual* structure. It is neither verbally or visually accessible to our awareness, yet the visual system can effortlessly obtain this representation via its internal mechanisms for shape abstraction (Kovacs, Feher & Julesz 1998). Hence the ability to immediately sense the harmony, balance, asymmetry, hierarchy and order of the entire composition is void of the percept of *what* it is which has those qualities. Again, I would suggest that this is a case where a component of the logic behind *yugen* has successfully been pinned down.

> The special characteristics of this structural hierarchy in empty space are lost after alteration of the original composition, and at best arises only once in every 10^{14} random attempts to cast stones into a similar space (Van Tonder, in press b)

Similarly structured empty space is also found in Zakkein (Van Tonder, in press a) and Ryotanji (Van Tonder, unpublished). All three temples belong to the Myoshinji temple complex in Kyoto.

Canonical viewpoint

Each individual stone is intentionally arranged such that a preferred facet of the rock faces the canonical viewpoint of the garden. This arrangement eases the perception of local structure and relationship between viewer and design components.

Figure 3
Japanese Cedar, attributed to Kano Eitoku 16th century, Tokyo National Museum. The tree as a whole, and its branches and leaves all face towards the viewer.

At least in the case of the three Myoshinji temples, the findings that empty space is hierarchical, that it has a convergence point and that it faces the canonical viewpoint in an intentional manner, point to another bridge between sensory perception and viewer intention. I propose that the canonical viewing position provides intentional alignment between the exocentric (object centered) representation of the design at an abstract level, and the egocentric (viewer centered) perception of the design (Van Tonder, 2006 a), engendering unhindered perception of deeper nuances of the design. This principle is also used in most other Japanese art forms, including *ikebana* (flower arrangement) and painting. In *ikebana* the flower design as a whole would face the viewer, while individual leaves and flowers are often oriented so as to systematically avoid facing the viewer directly. In painting one more often finds that parts and wholes are all tuned to face the viewer (see figure 3), compensating for the fact that a flat,

painted surface offers less rich optical visual interaction than a three dimensional arrangement of flowers.

Conclusion

The above examples show that one can discern a relatively clear logic in the design of *karesansui* gardens. It is not applied blindly throughout all garden designs, but gives helpful instances of how logic finds its way into otherwise evasive intuitive concepts.

Specifically, this logic is concluded to focus on two levels of experience as the viewer visits the garden. First, a deep sensory impact is delivered upon entrance to the garden, matching the egocentric expectations of the visitor. At the next level, senses are silenced to invite a similar silencing of viewer intentions. Abstract visual information is delivered to heighten the sense of close alignment with an infinite, complexly ordered extension of one's consciousness, indistinct from the garden, and ultimately unseen.

Hayao Kawai, a pioneer in the Japanese psychological arena,* claims that the fundamental difference between Western and Japanese consciousness lies in the fact that the Western mind is schooled towards a dichotomy of consciousness into 'self' and 'other'. 'I' see the 'rock'. The native Japanese way of being in the garden would not distinguish between the self and the elements of the garden in such a way. The focus of consciousness would be on the unity of the components, where rock and human constitute a fused consciousness.

Science, striving for objectivity, still faces a dilemma in bridging this gap. By improving our understanding of how the perceptual apparatus is brought into a state where unity between human and garden is experienced, science may meaningfully contribute to this seemingly metaphysical experience.

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